DOCUMENT RESUME

ED 254 737 CE 041 029

TITLE	Guide for Industrial Arts in South Carolina Schools.
INSTITUTION	South Carolina State Dept. of Education, Columbia. Office of Vocational Education.
PUB DATE	82
NOTE	47p.
PUB TYPE	Guides - Non-Classroom Use (055)
EDRS PRICE	MF01/PC02 Plus Postage.
DESCRIPTORS	Course Content; Educational Administration; *Educational Facilities Design; Educational Facilities Planning; Educational Philosophy; Elementary Secondary Education; *Industrial Arts; Laboratories; *Program Administration; Program Content; *Program Development; *Safety; State Curriculum Guides; Statewide Planning; *Teacher Education
IDENTIFIERS	South Carolina

ABSTRACT

This guide is designed to assist the administrator and the industrial arts teacher in carrying out their duties and providing an effective industrial arts program. An introduction defines industrial arts education, presents a philosophy, lists goals and objectives of industrial arts, and provides examples of typical relationships between industrial arts and other school curriculum subject fields. Section 2 describes the programs at the elementary school, junior high and middle school, and senior high school levels (activities, purpose, organization, course content, curriculum). Special programs and program evaluation are addressed. A recommended organizational plan is included. Section 3 provides names and addresses of professional and student industrial arts organizations. Section 4 on laboratory facilities offers a philosophic statement and recommendations for general planning. Teacher preparation, requirements for a professional certificate in industrial arts, and inservice education activities are discussed in section 5. Section 6 on management lists responsibilities of the state supervisor, local supervisor, school principal, and teacher. Section 7 focuses on safety--teacher responsibility, state safety law, and teacher liability. A reference section is organized by industrial arts areas. An equipment list is appended. (YLB)

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ED254737

GUIDE FOR

INDUSTRIAL ARTS

IN

SOUTH CAROLINA SCHOOLS

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South Carolina Department of Education
Office of Vocational Education
Vocational Curriculum Development Section
Columbia, SC 29201

1982

SOUTH CAROLINA DEPARTMENT OF EDUCATION

Dr. Charlie G. Williams, State Superintendent of Education

Division of Instruction
Sidney B. Cooper, Deputy Superintendent

Office of Vocational Education
Dr. Moody M. Oswald, Jr., Director

Vocational Curriculum Development Section
Dr. Robert T. Benson, Chief Supervisor

South Carolina Department of Education: An Equal Opportunity Agency
Columbia, South Carolina 29201

FOREWORD

According to the Education, Employment and Training Committee of the United States Chamber of Commerce, industrial productivity will rise substantially in the next five years with a commensurate growth in the need for skilled manpower. American technology is making demands upon the educational system. Preparing students to better understand modern technology and to develop skilled manpower needs presents a tremendous challenge to industrial arts education. This growth in technology and a rapidly changing society are forcing innovation and the incorporation of new teaching methods in classroom activities.

The success of the industrial arts program depends upon qualified and innovative teachers, a philosophy which allows for growth, a cooperative effort between the business community and the educational process, and, most importantly, a classroom atmosphere nurturing student motivation to pursue a fulfilling and exciting educational experience. This guide has been prepared to assist the administration and the industrial arts teacher in carrying out their duties in meeting the challenges, demands, and responsibilities placed upon them.

Charles G. Moore
State Supervisor
Trades and Industrial Education

ACKNOWLEDGEMENTS

Recognition and grateful appreciation are extended to the following members of the Industrial Arts Curriculum Committee. Their valuable contributions led to the revision of the 1973 guide and the production of this guide for use in the schools of South Carolina. Special thanks is extended to Mrs. Shirley Crook, Assistant State Supervisor for Trades and Industrial Education, for serving as resource person for this committee and to Dr. William E. West, Professor of Industrial Education at Clemson University, who also served as resource person from the college community. Development and compilation was directed by Ms. Margaret R. Gregory, Vocational Curriculum Designer, Vocational Curriculum Development Section, State Department of Education.

Lloyd Steele
A. C. Flora High School
Columbia, S. C.

Bill Sissel
Hughes Middle School
Greenville, S. C.

Gil Huggins
Westminster High School
Seneca, S. C.

Danny Holland
Woodruff Junior High School
Woodruff, S. C.

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INTRODUCTION

Definition of Industrial Arts Education

Industrial arts education is that segment of the total educational program conceived and designed to interpret, humanize and make meaningful to all students the basic functions and concepts of industry and technology through a broad spectrum of experiences and activities with the material, processes, and related problems of our industrial-technological society.

Philosophy

Industrial arts is a study of industry and its technology for the purpose of general as well as industrial education. Through instructional and laboratory experiences, students learn about the industrial, technical aspects of life. The instructional content deals with the origins and development of industry, and the tools, materials, processes, products, energies, opportunities, organization, and problems involved in converting the earth's resources into material goods.

Industrial arts as a part of the total educational program is just as important to the growth of the student as are the areas of English, mathematics, social studies, science, foreign language, and other subjects considered necessary to prepare our citizens for everyday life. In fact, industrial arts finds itself in the unique position of actually being able to apply much of the knowledge gained in these other courses to practical, everyday aspects of living. We must remember that people have always had to be able to use their minds to study, to think, and to plan, but they also have had to make a practical application of this knowledge for progress to take place.

As a part of the student's general education, industrial arts has an obligation to provide a program that is designed to offer something to all students. We must not draw a line based on the sex, intelligence, and aptitudes of those students we are willing to accept.

Industrial arts, a laboratory-type course, should always allow for individual differences. The instructor must be sufficiently flexible in the presentation of material to provide for the gifted student as well as the slow and the average learner.

Goals[1]

If different results are to be achieved at the elementary, junior, senior, and post high school levels, the goals, subject areas, and methodology employed should also vary. There are certain goals which are unique to the study of industrial arts and are not shared by other subject areas. At the same time, there are goals which are valid for all operational levels of industrial arts as well as for other subjects from elementary to post high school programs.

To provide a sound program of industrial arts, clear and realistic goals are essential. The following five goals are advocated as unique to industrial arts.

[1]American Vocational Association, *A Guide to Improving Instruction in Industrial Arts* (Washington, D.C.: American Vocational Association, 1968).

Develop an Insight and Understanding of Industry and Its Place in Our Culture

Since one of the predominant characteristics of our society is industrialism, understanding this aspect of our culture with all of its implications is essential for all school youth. Each student's opportunities and experiences relating to industry will help the student to better understand the society in which he/she lives.

The historical and social aspects of the evolution of our modern industrial complex are important phases of a study of this nature. While studies may be conducted through courses in the social sciences, it is difficult to understand the complexities of a modern industrial society only through vicarious experiences.

A fuller understanding of the industrial revolution, modern mass production, and automation will occur if the student participates in meaningful experiences. These experiences should deal with the complexities inherent in the manufacture of consumer goods, utilization and generation of energy, and the servicing, testing and repairing of the products of modern technology.

Discover and Develop Talents, Aptitudes, Interests, and Potentialities of Individuals for the Technical Pursuits and Applied Sciences

Students have a diversity of talents. Opportunities for students to discover abilities and develop them to their fullest are essential to the basic education of all youth. Efforts should be made to allow for differences in abilities and needs and to ascertain which learning experiences are the most significant for the success of each individual. Thus, a student can better assess his/her potentialities and interests when making an occupational choice, understand his/her environment, and condition himself/herself to the rapidly changing demands of technology and society.

The ramifications have been a major concern of industrial arts, especially on the junior high school level. In the past, a well-rounded and well-planned industrial arts program has been instrumental in assisting young people to make occupational decisions. If the industrial arts program accomplishes nothing else, it can be considered justifiable on the basis that it does provide students with experiences which, for the most part, are unobtainable in any other high school subject.

Develop an Understanding of Industrial Processes and the Practical Application of Scientific Principles

Experiences in industrial arts provide the student with an opportunity to utilize knowledge of science, mathematics, and other facets of general education in solving practical, technical problems.

The field of industrial arts is concerned with the study of integration of physical, chemical, and other forces with the materials and processes of industry, coupled with an active interest in the creative use of design. Industrial arts courses have their content cast in science and mathematics.

A program of industrial arts should foster experiments, research, exercises, and opportunities for solving various types of technical problems as well as project-making.

The storehouse of scientific information is becoming fuller and richer. Research and development is now an organized industry. The waiting time between discovery and practical usage is largely a thing of the past. The "lead time" between scientific information discovery and practical production is figured in months rather than decades. This wedding of the technologies with science should be reflected in the curricula of public schools. Industrial arts can serve an important function in dispensing knowledge of practical scientific applications and enriching the science offerings of the school curricula.

Develop Basic Skills in the Proper Use of Common Industrial Tools, Machines, and Processes

Industrial arts provides students with basic skills which are relevant to industrial occupations and later may assist the individual in successful occupational adjustment.

Many present-day workers, and certainly a majority of the workers of the future, will be required to train and retrain for several different occupations during their working careers. A solid grasp of fundamental skills and knowledge concerning diversified areas is therefore essential if this retraining is to be accomplished rapidly and thoroughly.

This segment of industrial arts instruction provides opportunities for developing manipulative skills. The students use these skills to achieve their goals and to understand industry.

Contact with, and success in, manipulative experiences involving industrial products, processes, and materials can lead to a richly rewarding lifetime of leisure time activity. The *do it yourself* trend which has become a modern phenomenon shows no indication of decreasing as witnessed by the many new tools and materials developed for home usage and consumption. Therefore, the safe and proper use and maintenance of such *do it yourself* devices is an important part of the course.

There is a great fear that industrial arts could become a theory-oriented course of instruction dealing only with the nonmanipulative aspects of the practical arts. In striving for greater general acceptance of content by upgrading and updating the theoretical aspects of the curriculum, the important approach of learning by doing must not be lost. On the other hand, for too many years emphasis on manipulative skills has reigned supreme and sometimes has become the end in itself of industrial arts education rather than a teaching tool to enrich and improve instruction in the total program. Somewhere between these two extremes, the modern industrial arts program must interpret the industrial world of today for youth and adults.

Develop Problem-Solving and Creative Abilities Involving the Materials, Processes, and Products of Industry

The problem-solving approach in industrial arts involves creative thinking. It also allows students to define and determine logical solutions to problems and to evaluate the visual and intellectual effectiveness of their solutions.

These kinds of experiences provide environments where the scientific and technological minds can begin to appreciate tools, machines, processes, and materials and where opportunities are provided for increasing knowledge and reinforcing beliefs.

The very nature of our laboratory setting makes possible a concrete, understandable approach to teaching problem solving and critical thinking.

If creativity is to be fostered, a concentrated effort to recognize, encourage, and nurture inquisitive minds in the classroom and laboratory must be maintained. This effort requires flexibility with regard to methodology, a system of change to match changing conditions, and content to allow a certain amount of creativity and pragmatic problem solving.

Objectives

The objectives for industrial arts are written in behavioral terms. This approach deals with the performance (changes in behavior) a student is to exhibit upon completion of a learning activity. The three behavioral domains are the cognitive domain (mental processes), the affective domain (attitudes and values), and the psychomotor domain (manipulative skills). Although behaviors cannot be easily separated into the three domains, each should receive consideration when formulating behavioral objectives.

The following behavioral objectives were determined to best evaluate the student's performance in industrial arts.

Given a current newspaper classified section, the student will be able to identify five worker traits for at least twenty-five different employment opportunities in the field of industrial technology.	Learning experience will provide opportunities to identify aptitudes, abilities, and interests which are meaningful to *career selection.*
Given a technological article in a current industrial magazine, the student will demonstrate the technical literacy, insight, and knowledge essential for living and functioning successfully in today's rapidly advancing technological society by answering oral questions with at least 85 percent accuracy.	Learning experience will promote *technological literacy* in youth and adults.
Given an occupational area, the student will demonstrate a skill level commensurate with the employment entry level skills of that particular occupational area.	Learning experience will develop basic *skill* in the use of tools, machines, and materials.
Given five current industrial products, the student will be able to identify any construction faults with 100 percent accuracy; all construction materials with 85 percent accuracy; and all products that fail to fulfill their design function with 90 percent accuracy.	Learning experience will develop attitudes, individual involvement, and a realistic evaluation for *consumer awareness.*
Given a teamwork situation and a project construction, the student will demonstrate cooperation, consideration, and understanding toward others and pride in his/her work by performing at the level of current industrial standards.	Learning experience will provide opportunities for *personal and social growth.*

Given current shop practical problems, the student will demonstrate transfer of learning in at least 85 percent of the solutions.	Learning experience will provide opportunities for *reinforcement* of learning in other subject areas.
Given ordinary classroom shop conditions, the student will demonstrate current industrial safe work habits in 100 percent of all shop work.	Learning experience will be to develop *safety* habits.
Given a list of twenty-five recreational pastimes, the student will be able to list at least five do-it-yourself type projects for each area.	Learning experience will contribute to improve *recreational time.*

Relationship of Industrial Arts Education to Other School Curriculum Subject Fields

Industrial arts education has many factors in common with other subject fields, such as content, principles, academic skills, knowledge, and attitudes. The following examples list some typical relationships.

Fine Arts – Students apply knowledge of materials and tool processes to design. The adapting and combining of design elements in projects is encouraged. The ability to recognize and appreciate good design and construction is developed. Opportunities are provided for creative activity. Acquired technical skills are applied to design and construction problems in the fine and dramatic arts.

Health and Recreation – Students develop safety attitudes for home, community, and industry. Personal hygiene is practiced. Students learn to build recreational equipment. The therapeutic values of working with tools and materials as hobby and recreational activities are emphasized.

Language Arts – Students utilize oral and written communication in school laboratory activities. Vocabulary is increased and enriched through the understanding and use of industrial terms. Special language skills are developed by written technical reports, specifications, material orders, and by using handbooks, catalogs, books, and reference materials.

Mathematics – Students make extensive use of measuring processes. Accuracy and computational skills are developed. A wide range of experiences is provided in the use of symbols and formulas. Computations are an integral part of many processes and jobs. Concepts of tolerance are developed. Skills are acquired in the estimating and judging of size, quantity, and fit.

Science – Students are given opportunities for research, investigation, and experimentation. The scientific method is used in solving problems in the school laboratory. Mechanical skills are developed which are necessary in the construction of equipment for scientific experimentation.

Social Studies – Students practice democracy in establishing procedures for laboratory management. Effective human relations are developed by student participation in laboratory management, by working together, and by sharing tools and facilities. Emphasis is placed on conservation when studying human and physical resources. Industrial materials and production methods are studied. A knowledge of history, geography, and economics is gained through the study of industry.

Industrial Education – Students obtain information concerning requirements of occupations and discover vocational interests and aptitudes. Technical knowledge is applied to the solution of typical industrial problems. Tool and machine skills and accuracy are developed. Mass production, planning, and manufacturing techniques are used. Advanced students have an opportunity for some concentration in an industrial occupation.

INSTRUCTIONAL LEVELS

Elementary School

Industrial arts activities can greatly enhance the learning of the child at the elementary level. The resourceful elementary classroom teacher with the desire to make classroom learning relevant and with minimal assistance in the form of tools, supplies, and instruction will be able to use industrial arts to achieve this relevancy.

Most elementary classroom teachers touch upon the content of industrial arts at various times while teaching other school subjects such as reading, mathematics, science, and social studies. These subjects include information about people doing things; activity which causes *things* to be made, moved or changed to some degree to satisfy a person's needs.

The purpose of industrial arts in the elementary school is to provide an opportunity to study how a person satisfies the desire for material goods. This study permits the student to learn, through the application of knowledge gained in other subjects, the skill of using what he/she has learned. At the same time, the student is gaining new insights and concepts about the use of this knowledge and the need for acquiring certain skills.

On the primary level (K-3), studies are usually based on broad units about the home and community. These units focus on food, shelter, clothing, communication and transportation as major points of study. At the intermediate level (4-6), studies are based on *life* in nature or the world using topics similar to those studied in K-3.

Industrial arts activities may be carried on in the regular elementary classroom by the classroom teacher. Provisions for equipment and tools to be used by the class are minimal. Work space may be desk tops and simple hand tools (hammers, screwdrivers, saws, etc.). The demand for these provisions will vary as the class moves from one study topic to another. It may be advisable to have equipment and tools which are transferable from room to room as needed.

The school administration should provide industrial arts training for the elementary classroom teacher through in-service education, workshops, part-time consultants and/or a resident supervisor. Through the teacher, industrial arts can become an integral part of the day to day classroom activities.

Junior High and Middle School

The junior high and middle school industrial arts program offers adolescent youth a variety of laboratory experiences organized to teach broad industrial understandings. Through experiences structured to include many of the management, production, and personnel practices of industry, the students study the processes, tools, materials, and products of industrial technology. The industrial arts experiences may be grouped by major industries (metalworking, graphic arts, etc.), industrial materials (woods, plastics, metals, etc.), or specific industrial processes (welding, drawing, machine shop). The focus of the industrial arts courses, however, is on the function of industry.

The study of industry through exploratory experiences is the primary purpose of junior high and middle school industrial arts courses. The industrial arts program includes an opportunity for the student to experience planning, completing, and evaluating industrial-related activities. Through these exploratory experiences, the student develops the insight and understanding of his/her potential or limitations in today's highly industrialized adult world.

The middle or junior high school industrial arts program is an on-going program in many South Carolina schools. These industrial arts programs are fulfilling their basic goal of providing exploratory experiences based on an organized study of industry. The challenge is to revise and expand their course content to better fulfill the responsibility with which they are charged.

Industrial arts programs should include attempts to innovate in their course offerings. Exploratory programs designed around broad industrial content and required of all students are currently in operation. Other schools have moved to include instructional programs based on broad-structured industrial arts programs such as *The World of Construction.*

The major concern in organizing instructional content for the middle and junior high school industrial arts program is to provide a broad study of the industrial application of knowledge of practice, rather than concentrating only on the manipulative practices of narrowly defined industrial groups or crafts.

The industrial arts instructional program should be organized to provide exploratory study of how (1) industries are formed and managed to satisfy human needs; (2) industries change a variety of materials in form and structure thus adding value through processes; and (3) industries deal with people in terms of consumers, workers, and investors. The instructional content may be identified in terms of traditional titles (drawing, woodworking, metalworking, electricity, graphic arts, plastics, and ceramics), but the program should include a minimum of four areas of instruction. The content of these areas should be selected to present not only the production practices associated with making things, but also the management task and personnel inducement needed for the production of goods. The manipulative activity for the industrial arts program will not be predicated on the development of skill in tool use. The laboratory experiences are provided to enhance the opportunity for learning about the material by means of active student participation through the practical application of knowledge.

The following list presents possible activities to be considered for the development of industrial arts course content built around the traditional areas of instruction.

Drawing	Pictorial sketching, making data tables—charts—graphs; graphic paper layout of equipment, rooms, and buildings; the preparation of graphic materials for reproduction
Woodworking	Experimenting with a variety of woodworking handtools and portable or stationary power equipment operations; comparing the shaping, forming, combining, and assembling processes associated with wood products
Metalworking	Experimenting with a variety of metalworking handtools and portable or stationary power equipment operations; studying through performance the shaping, forming, combining, and assembling processes associated with metal products

Electronics	Exploratory activity in designing, assembling, and altering electrical components or systems; experiencing the application of scientific knowledge relative to electrical products or system development
Graphic Arts	Introductory activity in developing and producing image transfer devices such as block–screen–offset printing; photography; the processes relative to collecting, assembling, distributing, and utilizing graphic components or products
Industrial Crafts	Experimenting with a variety of materials, processes, various hand and power tools, and machines of the crafts to change materials into finished parts or products by means of casting, injecting, extruding, coating, and firing

In summary, the industrial arts program for the middle or junior high school must be organized to include experiences involving a broad base of industrial activities utilizing a variety of processes, tools, materials, and personal relationships. The learning situation should be based in a laboratory capable of dealing with a variety of individual and group learning experiences. This situation should also allow experiences which involve a variety of processes, materials, tools, and equipment.

Senior High School

The industrial arts curriculum in senior high school contributes greatly to the overall educational program as it relates to the functions, technology, and occupational opportunities of our modern industrial society. It provides freedom for the students to study and explore the aspects of industry as they relate to industrial and consumer use of products. This exploration enables the student to see and experience the broad realm of industrial processes in modern industry.

The high school industrial arts curriculum should provide adequate basic instruction to meet the needs of (1) college-bound students; (2) students exploring more deeply the vocational, cultural, and consumer aspects of American industry; (3) students planning to pursue advanced study and careers in the areas based on and relating to the applied or technical sciences, and (4) students who will be entering the labor force prior to or immediately following graduation. To satisfy this demand, the industrial arts program should provide practical situations dealing with the industrial world of work, and provide for the development of an understanding of the industrial dimension of our society.

The senior high school industrial arts instructional program should be organized with a *general laboratory* (a variety of instructional areas provided), or the *unit laboratory* (structured to study one industrial material or industrial process). Either organization should include instruction directed to current industrial utilization of the processes studied. A minimum of four subject areas should be provided if the industrial arts program is to serve the in-depth study needs of a variety of student interests. The following program descriptions and purposes are listed as typical high school offerings.

Area	Program Description	Purpose
Drafting	The study of the communication of ideas through drawings, sketches, charts, graphs, and maps. Learning experiences include the development of skills through the use of drafting instruments involving lettering, sketching, geometric construction, orthographic projection, pictorial drawings, auxiliaries, sections, and working drawings.	To acquaint the students with the basic knowledge and skills common to all areas of drafting including the specialized and allied fields and to develop an awareness of the occupational and educational opportunities existing.
Woodworking	The study of the wood manufacturing industry and the technology involved in the construction of buildings and the manufacturing of articles made from wood and wood products. Learning experiences include experimenting, designing, constructing, operating, and evaluating industrial tools, processes, forest products, and related synthetic materials.	To acquaint the students with the woods industries through the exploration of the materials and processes used in the specialized and allied fields of wood technology and to develop an awareness of the occupational and educational opportunities existing.
Graphic Arts	The study of the tools, materials, and processes of the printing industry including block printing, intaglio printing, letterpress printing, lithography, photography, silk screen printing, thremography, type composition, and binding. Learning experiences include designing, composing, printing, and evaluating reproduction techniques, and the study of history, economics, occupations, and consumer information related to the printing industry.	To acquaint the students with the graphic arts industry through the exploration of the materials and processes used in the specialized and allied fields of graphic arts and to develop an awareness of the occupational and educational opportunities existing.
Metalworking	The study of the tools, materials, and processes used in the metals industries. Learning experiences include experimenting, designing, fabricating, forming, and evaluating metals and metal products.	To acquaint the students with the metals industries through the exploration of the materials and processes used in the specialized and allied fields of metal technology and to develop an awareness of the occupational and educational opportunities existing.

Area	Program Description	Purpose
Electronics	The study of sources, measurement, control, and applications of electrical energy in devices such as those used in heating, power, and illumination, as well as those used in communications, e.g., the telegraph, telephone, radar, and computers. Learning activities include demonstrating, experimenting, designing, constructing, and testing electrical devices.	To acquaint the students with the basic theories of the electronics industry through the exploration of the techniques and procedures used in the specialized and allied fields of electronics and to develop an awareness of the employment and educational opportunities existing.
Power Technology	The study of the development, transmission, and utilization of power, including the theory, maintenance and servicing of machines and devices for the conversion of power into useful forms. Methods and devices for the transmission of power and output machinery for utilizing power are emphasized.	To acquaint the students with the principles of the common power sources used in our present technological society through the exploration of the specialized and allied fields of power technology and to develop an awareness of the employment and educational opportunities existing.
Industrial Crafts	The study of cottage and industrial crafts including the tools and processes used to produce well-designed products from a wide variety of materials such as ceramics, leather, rocks, fibers, metals, and woods. Learning experiences generally include experimenting, designing, constructing, and evaluating useful products with emphasis on industrial applications.	To provide students with an opportunity to express themselves through a variety of materials and processes for possible self-employment as well as vocational pursuits.
Textiles	The study of the problems and operations involved in the manufacture of textile fibers and textile products with special emphasis on technical information, processes, materials, and equipment. Learning experiences include experimenting, creating, designing, fabricating, and evaluating textile products.	To acquaint the students with the textile industries through the exploration of the materials and processes used in the specialized and allied fields of textiles and to develop an awareness of the occupational and educational opportunities existing.

Special Programs

Industrial arts education programs may also be organized to meet specialized needs for adults, the educable mentally retarded, the physically handicapped, and the mentally gifted. Team teaching by the industrial arts instructor with special education teachers is recommended for classes of mentally and physically handicapped students.

Adults

Adult classes can be geared to the study of technical subjects for the purpose of creativity, craftsmanship, occupational exploration towards more specific vocational training, self-improvement, hobby development, and general maintenance and repair skills. Typical adult courses might include electricity, radio, mechanical drawing, photography, woodwork, upholstering, art metal, model making, and small engines and furniture refinishing. Adult courses should be highly individualized, varied in offerings, and designed to meet community needs.

Gifted

Classes for gifted students may be accelerated and correlated with other departments such as mathematics, science, fine arts, social studies and foreign language. Students preparing for future careers in engineering or other technological professions might follow a program including courses in drafting, electricity, power mechanics, and metal and woodworking.

Special Needs

Special programs can be developed to contribute significantly to the experiences of the educable mentally retarded and the physically handicapped student.

Selected activities in industrial arts for the low ability student can provide satisfying and successful experiences and may motivate them to better performances in other subject areas. The personal satisfaction gained by these students sets the stage for improved attitudes and proper morals. This group has a wide range of abilities but many are dropouts because they are not achieving satisfactory experiences in the regular program. A special industrial arts program is one method of motivating this type of student.

The physically and emotionally handicapped student can derive extensive benefits from industrial arts. In addition to the skills and

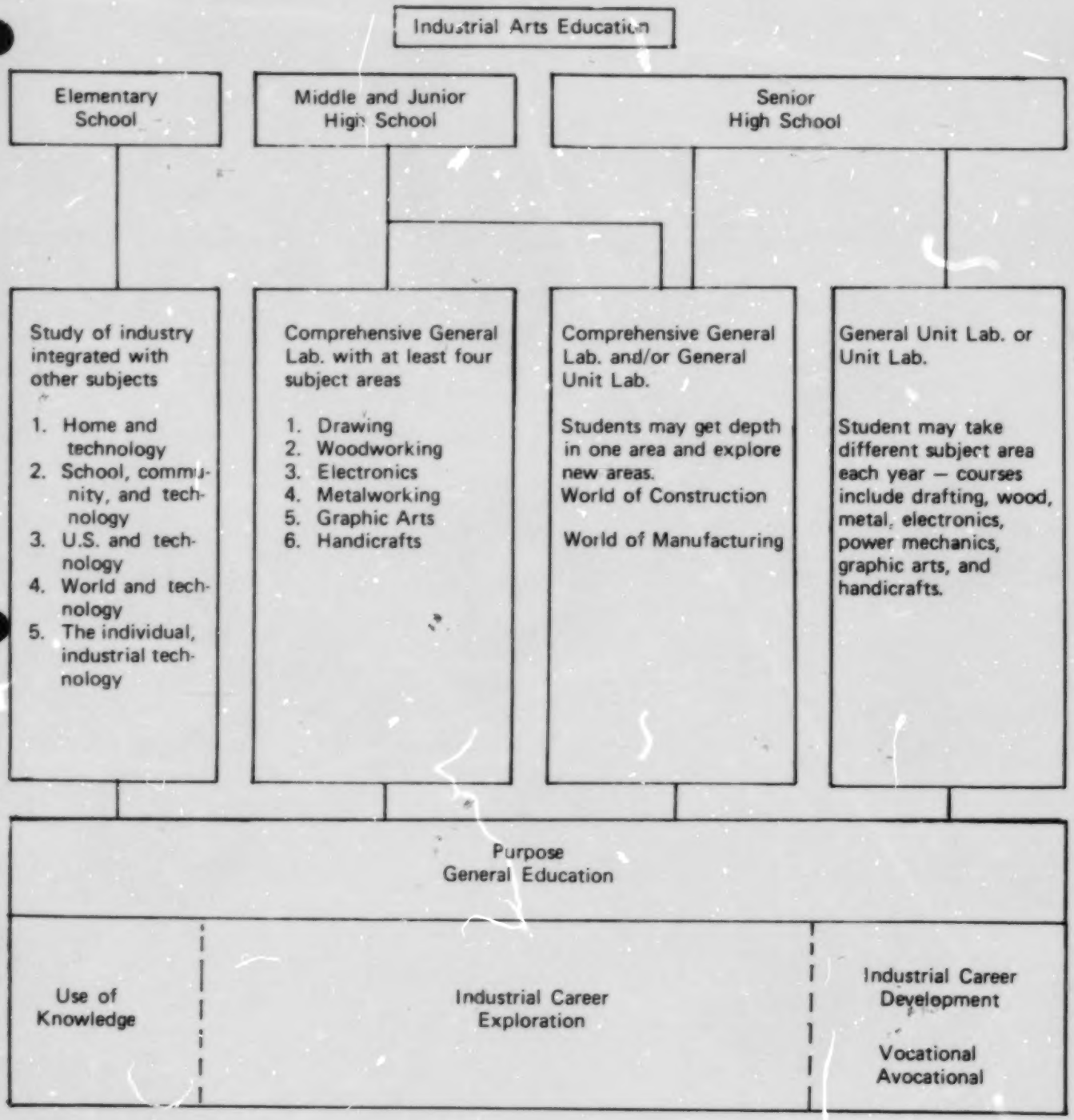
knowledge acquired, the various manipulative activities may be utilized for the diagnosis and therapeutics essential to development and rehabilitation. Industrial arts activities can assist many of these students in making the satisfactory adjustments necessary for successful entry into employment.

Program Evaluation

The problem of program planning and evaluation of ongoing programs is a difficult and complex task. While planning and evaluation instruments are available, they alone cannot effectively measure the worthiness of the total industrial arts program. They must be supplemented by an awareness of area and local needs and problems. However, they do provide general direction and avenues for improvement, and promote the interaction so necessary for ongoing program planning.

Improvement of the industrial arts instructional program will only come about by means of continuous program planning and reexamination of existing course offerings. Industrial arts, just as that element of our society which it structures itself to teach, must keep abreast of present day industrial practices. Persons charged with the responsibility of industrial arts program planning must find the instructional content in *today's* industry, not historic industry.

RECOMMENDED ORGANIZATIONAL PLAN


Industrial Arts Education
Elementary School
Middle and Junior High School
Senior High School
Study of industry integrated with other subjects
1. Home and technology
2. School, community, and technology
3. U.S. and technology
4. World and technology
5. The individual, industrial technology
Comprehensive General Lab. with at least four subject areas
1. Drawing
2. Woodworking
3. Electronics
4. Metalworking
5. Graphic Arts
6. Handicrafts
Comprehensive General Lab. and/or General Unit Lab.
Students may get depth in one area and explore new areas.
World of Construction
World of Manufacturing
General Unit Lab. or Unit Lab.
Student may take different subject area each year — courses include drafting, wood, metal, electronics, power mechanics, graphic arts, and handicrafts.
Purpose
General Education
Use of Knowledge
Industrial Career Exploration
Industrial Career Development
Vocational
Avocational

INDUSTRIAL ARTS ORGANIZATIONS

Professional

Professional organizations should define and foster professional ideas for their members and promote the improvement of industrial arts education in the schools of South Carolina. The following organizations are within the state.

South Carolina Industrial Arts Education Association

South Carolina Vocational Association
(The industrial arts group is in the new and related section.)

South Carolina Graphic Communication Instructor's Association

The following organizations are at the national level.

American Industrial Arts Association
1201 Seventh Street, N.W.
Washington, D. C. 20336

American Vocational Association
2020 North 14th Street
Arlington, Virginia 22201

Many benefits are available through these professional organizations. Contact Trade and Industrial Education, Office of Vocational Education, for more information concerning dues, eligibility, etc.

Student

The *American Industrial Arts Student Association (AIASA)* is the only national organization devoted exclusively to fostering industrial arts at the elementary, junior/middle, and senior high school levels of education.

For information on forming local chapters or state associations, contact:

American Industrial Arts Student Association
1201 Sixteenth Street, N. W.
Washington, D. C. 20336

or

Department of Industrial Education
106 Freeman Hall
Clemson University
Clemson, South Carolina 29631

LABORATORY FACILITIES

Philosophic Statement

In planning the industrial arts education laboratory requirements for a particular school, many factors should be considered such as the grade levels to be served, the scope of the curriculum, and both the potential school enrollment and the anticipated enrollment in the industrial arts education program. These factors determine the type and number of laboratories needed, as well as the size, type, and quantity of equipment necessary for each laboratory.

Planning pays dividends in constructing new facilities, remodeling existing facilities, or rearranging the layout in existing industrial arts education laboratories to facilitate a curriculum revision. Experience has shown that poor initial planning usually results in long-lasting ill effects to the program. In planning any new facility or changing an existing one, it is extremely important that the teacher give adequate input to the consultant or architect. The needs of an industrial arts lab are different from those of a vocational or technical program. The instructor, the supervisor, the administrator, the advisory committee, and the group of participants concerned with the educational program should take part in the planning. Special emphasis should also be given to meeting the needs of physically handicapped students. Consideration should be given to such things as counter heights, machine switch locations, aisle width, tool access, etc.

General Planning

The following recommendations may be used in planning laboratories in most communities with necessary modifications to meet the needs of the students.

Size, Shape and Location (Size will depend upon activities to be taught.)

1. A laboratory area, square or of rectangular shape not exceeding a ratio of one to two, is best. All parts of the laboratory should be visible to the instructor. This may call for the use of transparent panels in partitions, office, and classroom walls.

2. Experience suggests that there be not less than 50 square feet per student where light work is done; 100 square feet where heavy work is done; and 125 square feet where assembly areas are needed. This is exclusive of storage space and equipment space.

3. Minimum total floor area for laboratory, drawing room, planning room, and storage room should be not less than 3000 square feet. Of the total area, not less than 1800 square feet should be provided as a basic teaching area.

4. Floor space of laboratory should be on one level and preferably located on the first level or floor.

5. Lab ceiling should be at least 12 feet. Additional height for a hydraulic car lift or vertical storage of materials should be provided when necessary.

Walls, Floors and Ceilings

1. Ceiling should be acoustically treated and walls should be constructed from materials that can be easily cleaned.

2. Partition between laboratories should be nonloadbearing walls of ceiling height and of semipermanent construction to permit future alterations.

3. Open beam ceilings should be avoided since they are dust collectors and become unsightly.

4. Concrete floors in drawing room, classroom, and planning room should be covered with floor tile.

5. Provide transparent panels or transparent panel door from wainscot height to 6 feet above the floor in partitions and doors between laboratory and auxiliary rooms since the teacher needs to be able to supervise activities in these areas from the main lab.

6. Where concrete floors are used and color is desired, the color should be added at the time the floor is poured. Consideration should also be given to the floor coating so as to prevent slick or slippery areas.

Windows and Doors

1. Windows should be designed to provide as much natural light as possible with the least amount of conflict with machines and other equipment.

2. Provide only one entrance as the regular means of student use.

3. Provide an 8' x 10' overhead door with service ramp and paved drive.

4. Door locks in laboratories should not be of the master key variety but different so access is possible by authorized persons only.

Illumination and Electrical

1. A minimum of 100 foot candles at bench height should be provided in laboratories and drawing rooms. Special location lights may be provided where necessary (see *State Facility Guide for Public Schools).*

2. Master safety switch control should be placed in all laboratories at predetermined location. This switch should be locked when lab is not in use to provide control of all machines. It is used when necessary during laboratory activities to cut off all machines in case of an accident. With the safety switch, all machines must have magnetic motor controls.

3. Lighting circuits should be separate from circuits for machines and wall outlets. (Overhead buss bars might be considered for heavy machines and portable power tools.)

4. Overhead buss bars, floor and wall outlets containing 220 volts single phase, and 110 volts should be provided to permit flexibility. A minimum of 25 percent above present electrical requirements should be provided for future needs. Consideration should be given to three-phase power in heavy duty laboratories such as the woodworking area.

5. At frequent intervals, locate convenience outlets in the walls of the laboratory at least 36 inches above the floor. Special consideration must be given to high voltage outlets.

6. All electrical equipment must be grounded.

Other Facilities

1. Equip finishing rooms with adequate exhaust, explosive-proof electrical fixtures, and storage for flammable materials.

2. A wash basin and a drinking fountain should be provided in each laboratory.

3. Unit-type heaters mounted near the ceiling are acceptable.

4. Provide chalk board and bulletin board space.

5. Adequate storage space for student projects and personal belongings should be provided. A minimum of 4 square feet per student is recommended.

6. A display case should be included for showing student work and displaying instructional materials. It should be well-lighted and contain glass shelves.

Equipment and Arrangements

1. Classroom equipment should be purchased with the needs of the left-handed and physically handicapped student in mind.

2. Provide dust collectors for machines and forced exhausts for fumes.

3. Machines that are used for roughing out stock should be placed near the storage areas.

4. Locate related instructional equipment together.

5. Provide aisles to commonly used areas. Provide ample space around equipment.

6. Provide open tool panels and/or mobile tool units, if practical. If not, have controlled centralized tool distribution area.

7. All power equipment should be adequately guarded.

8. Stationary equipment should be securely fastened to the floor.

Safety Considerations (a review of the safety unit)

1. Disposal containers for trash and used materials should be of an approved type.
2. Steel cabinets should be provided for the storage of flammable materials.
3. Laboratories should be equipped with carbon dioxide and soda acid-type fire extinguishers.
4. A laboratory should contain a well-stocked first aid kit.
5. Operator zones around stationary machines should be provided and painted the appropriate color.
6. For sanitation purposes, all sink drains should contain sediment traps to prevent drain clogs.

Tools and Equipment

A list of up-to-date tools and equipment for each type of laboratory may be secured through the State Supervisor or District Consultant for Trades and Industrial Education, Office of Vocational Education, South Carolina Department of Education.

TEACHER PREPARATION, CERTIFICATION, AND IN-SERVICE EDUCATION

Preparation

The teacher must possess sufficient skills to demonstrate all of the tasks the students are expected to perform. The teacher should be a graduate of an approved teacher preparation program in industrial education or industrial arts education. The prescribed teacher education curriculum should include courses in which the prospective teacher can gain proficiency in at least five industrial arts education subject areas. The teacher must also develop competency in *how to teach.*

The teacher preparation program leading to a Bachelor's Degree must include courses in General Education, Professional Education, and Industrial Arts Education. The requirements for a professional certificate in industrial arts are presented below.

Requirements

A. Bachelor's Degree

B. National Teachers Examination score of 570 on a teaching area examination

C. General Education – 42-45 Semester Hours

	Semester Hours
English	12
Biological and Physical Sciences	12
Social Studies	12
Health	2-3
Art and Music	4-6

D. Professional Education – 18 Semester Hours

1. Adolescent Growth and Development
2. Principles and Philosophy of Education
3. Principles of Learning, Secondary School Materials and Methods — 12

NOTE: 1, 2, and 3 must be represented.

4. Directed Teaching 6

E. Industrial Arts Courses – 24 Semester Hours

1. A minimum of three semester hours in each of four or more shop activities such as wood, metal, graphic arts, electricity, automotive, ceramics, plastics, textiles, trowel work, art crafts, etc. . .12

2. A minimum of four sememster hours in courses of related drawing and design, including at least two of the following: mechanical drawing, sketching, drafting, mechancial equipment and design, graphic arts design 4

3. Electives from any of the above listed courses 8

Certification

The certification of teachers depends on the applicant's college education, the National Teachers Examination score and the number of years of teaching experience.

A temporary certificate valid for one academic year can be issued provided that requirements A, B, and E are completely met and at least six semester hours of requirement D are satisfied in the previous section on requirements.

New teachers meeting the above educational requirements with no experience receive a probationary teacher's certificate which is valid for one year. Information on group, class, types of certificates, renewals, etc., may be secured from the Office of Teacher Education and Certification, State Department of Education, Columbia, South Carolina 29201.

Professional Growth

If industrial arts education programs in South Carolina's public schools are to keep abreast of the rapidly changing industrial society, teachers must make an effort toward self-improvement professionally, as well as technologically.

One of the best means of self-improvement is to attend summer courses which deal with the many aspects of industrial arts education. Summer programs presently being offered at Clemson University and South Carolina State College are designed to serve the teachers of industrial arts education. Until larger numbers of teachers participate in these programs, little can be accomplished. Before an adequate summer program can be offered by either of these institutions, there must be a demand for such programs.

Another way in which the teacher can keep abreast of the changing technology is through a planned program of cooperative work experience in industry during the summer. Such a program would be initiated by the teacher.

It is suggested that all industrial arts education teachers develop a personal plan for self-improvement by participating in the following activities.

1. Attend and participate in the Annual Summer Vocational Education Conference.
2. Attend summer school for six semester hours every three years.
3. Attend district workshops or conferences in industrial arts education.
4. Subscribe to and read the professional journals and magazines in the field of industrial arts education.
5. Become an active and participating member of the state industrial arts teacher's organization.
6. Work with industry during the summer.
7. Attend special workshops provided by industrial agencies and suppliers, i.e. Hobart Welding.

MANAGEMENT

State Supervisor

In the administration of industrial arts education, there must be communication between all areas of supervision and instruction from the classroom teacher to the state supervisor. The state supervisor, upon request, is an available consultant for questions related to industrial arts education. It is the responsibility of the state supervisor to:

1. Develop long-term programs of industrial arts education for the state.
2. Serve as consultant to all other industrial arts personnel.
3. Participate in county and district teacher meetings.
4. Distribute information to teachers.
5. Aid in the layout and design of facilities.
6. Counsel with teachers concerning local programs, college courses, certification and standards.
7. Coordinate work with state supervisor in other institutional areas.
8. Acquaint school officials and the general public with the philosophy, aims, objectives and status of industrial arts education in South Carolina.
   a) Make the *State Guide for Industrial Arts* available upon request.
   b) Keep teacher education departments informed relative to the supply and demand for teachers.
   c) Assist school districts in recruitment of industrial arts teachers.
9. Serve as a liaison between state and local administrative levels of industrial arts and industries within the state.

Local Supervisor

Depending on the size of the district or county, there should be one or more full-time or part-time supervisors of industrial arts education. It is the responsibility of the local supervisor to:

1. Coordinate the efforts of the different programs under his/her supervision.
2. Assist teachers in preparing instructional materials, including visual aids.
3. Assist in planning, organizing, and modernizing industrial arts laboratories.
4. Assist in organizing machines, tools, and supply list in local situations.
5. Promote safety practices in school laboratories.

6. Visit the program regularly.

7. Up-grade teacher qualifications.
   a) Promote professionalism.
   b) Plan and execute in-service teacher education.

8. Recommend qualified teachers for employment.

9. Coordinate program with other instructional supervisors at the local level. Advise local officials as to the number of students depending upon the type of student and the course being conducted.

10. Serve as a liaison between the industrial arts program, community, and industry.

School Principal

The principal is responsible for the administration and day-to-day supervision of all instructional programs included in the curriculum of the school. The principal must be aware of and seek to satisfy his/her responsibilities to industrial arts if the programs are to accomplish their objectives. The responsibilities of the principal relative to industrial arts are to:

1. Become familiar with the philosophy, aims, and objectives of industrial arts education.

2. Support and demand a comprehensive program.
   a) Provide an adequate budget for a comprehensive program.
   b) Provide the teacher with ample school time for on-going program development.
   c) Schedule industrial arts students in the middle, junior and senior high schools on the same basis as other subjects (English, math, or science).

3. Promote industrial arts within both the school and the community.

Teacher

The teacher carries out the plans formulated by the teacher and the supervisor. The responsibilities of the industrial arts teacher are to:

1. Plan, organize, and evaluate day-to-day instruction of industrial arts.
   a) Become familiar with the industrial arts program objectives for the state, county or district, and school.
   b) Work with school administrators (local and state) and community leaders in planning for industrial arts.
   c) Develop a course of study based on sound educational principles.

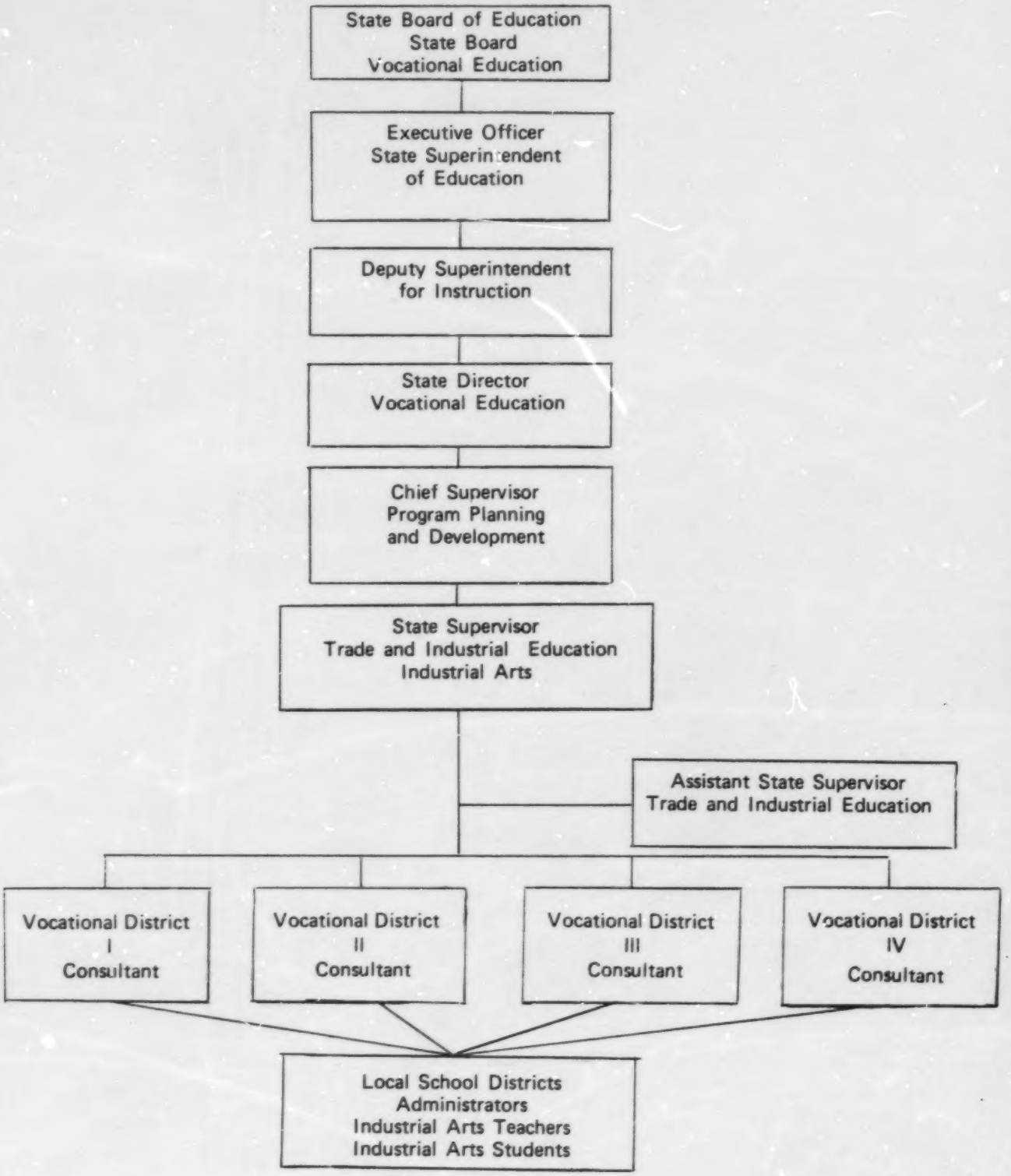
2. Conduct oneself and the classes in such a manner that the philosophy, aims, and objectives of industrial arts prevail.

3. Continually evaluate the program in terms of changing community and industrial needs.

4. Keep the public informed as to the content of industrial arts.

5. Establish and maintain a personal professional development plan.

ORGANIZATIONAL CHART
INDUSTRIAL ARTS



SAFETY

Introduction

A program of safety is a most important part of any activity where physical work is done either with hand tools or with machines. In many industries where elaborate safety programs have been set up, good records have been established as a result. Therefore, safe habits and practices must be a part of the students' training as soon as they begin in industrial arts.

Safety must be considered in every activity. Everyone must be conscious of safety so that accidents can be avoided. In addition, students must be prepared to aid someone in the event an accident does occur.

Safety in the industrial arts program consists of providing conditions that will be favorable to the general health of the students. Instruction that will guide in forming habits of procedure leading to the prevention of accidents should also be offered.

Safety practices are of such importance that they must be observed by the instructor and every member of the group. The safety program should be outlined and put into action on the first day of school. Safety should be a planned program of safety applications for the present as well as the future.

All students are prone to accidents. They can, however, be prevented by proper knowledge and skill, and positive safety attitudes on the part of the teacher and student.

Safety is an attitude accompanied by habits. The development of proper safety attitudes and habits is one of the primary objectives of industrial arts education teaching.

Major Responsibility

The major responsibility for laboratory safety instruction in accident prevention falls on the teacher. General responsibilities of the teacher in a comprehensive accident prevention program in school laboratories are listed below.

1. Incorporate safety instruction in the course of study.
2. Give instruction on potential hazards and accident prevention specific to the particular school laboratory.
3. Instigate a comprehensive safety program and enforce all rules and regulations.
4. Have set, preplanned procedures in case of an emergency.
5. Set proper safety examples for students to follow.
6. Keep informed about modern, acceptable safety practices in the field of accident prevention.
7. Regularly review laboratory facilities to provide for optimum safety conditions.
8. Carry out recommendations of the administrator for improving safety instruction.
9. Devise and enforce safe housekeeping procedures.
10. Insist on proper protective equipment in all shop areas and require students to wear the proper clothing and adequate hair guards while working in the laboratory.
11. Develop specific safety practices and regulations relating to the facilities.

12. Make recommendations to administrators for improving environmental safety conditions.
13. Produce prompt and thorough reports of accidents.
14. Be aware of the emotionally disturbed and accident-prone student.
15. Always provide adequate and legal *supervision* in the classroom or laboratory.
16. Insist that adequate eye protection be worn in all potentially hazardous areas.
17. Provide proper instruction in the use of all tools, machines, and equipment. Keep a record of each student's safety training.
18. Insist that guards meeting OSHA standards be provided and used whenever a machine is operated.

There should be no compromise with safety. Positive safety education is based on accident prevention. The *South Carolina Industrial Arts Safety Guide* should be used to supplement this chapter. It is available from the District Consultant, Trades and Industrial Education, or by writing to the Trades and Industrial Education Supervisor, State Department of Education, 900 Rutledge Building, Columbia, South Carolina 29201.

A listing of other safety materials is found in the reference section of this guide.

Additional emphasis for safety should also be given to the laboratory working area and its layout.

State Safety Law

The following excerpt defines the State Safety Law concerning eye protection.[2]

> Teachers and students participating in courses as outlined in South Carolina Code Act No. 377 shall be supplied plano protective eye devices.
>
> Act No. 377, An Act To Require The Public Schools Of The State To Supply Plano Protective Devices To Pupils And Teachers Participating In Certain Courses And To Require Pupils And Teachers Desiring Protective-Corrective Eye Devices To Secure Such Devices At Their Own Expense.
>
> Section 1. Certain students and teachers to wear protective eye devices. Every pupil and teacher in any public school participating in any of the following courses:
>
> a. Vocational or industrial arts shops or laboratories involving use of or exposure to:
>
> (1) Hot molten metals;
>
> (2) Milling, sawing, turning, shaping, cutting, or stamping of any solid materials;
>
> (3) Heat treatment, tempering, or kiln firing of any metal or other materials;
>
> (4) Gas or electric arc welding;

[2]South Carolina, Department of Education, *South Carolina Defined Minimum Program* (Columbia, S.C.: State Department of Education, 1980).

(5) Repair or servicing of any vehicle;

(6) Caustic or explosive materials.

b. Chemicals or combined chemical-physical laboratories involving caustic or explosive chemicals or hot liquids or solids; is required to wear industrial quality eye protective devices at all times while participating in such courses or laboratories. The trustees of each school district shall purchase and cause such plano protective eye devices to be placed in such public schools for the eye protection of pupils, teachers, and visitors to such classrooms or laboratories.

c. Any person desiring protective-corrective lenses instead of plano protective devices supplied by the school trustees shall at his own expense procure and equip himself with industrial quality eye protective devices secured from legally authorized dispensers.

The phrase "industrial quality eye protective devices," as used in this section, means devices meeting the standards of the American Standard Safety Code for Head, Eye, and Respiratory Protection, 22-1-1959, promulgated by the American Standards Association, Incorporated.

Teacher Liability

In order to adequately cover the concern of teacher liability, several sources were contacted for information and varification.

The Office of the Attorney General for South Carolina provided a court case for illustration in which the student who was struck in the eye by a nail thrown by another student during woodworking class brought action against the other student and the teacher. The decision was that the teacher had acted reasonably under the circumstances and was, as a matter of law, not negligent despite contention that if the teacher had on previous occasions dealt more sternly with rule infractions and disciplinary matters, the student might not have thrown the nail.[3]

The Attorney General's office also referred to the publication *South Carolina Teachers and the Law.*[4] Several statements from this publication are important for ready reference.

1. The teacher, having daily contact with the students, is responsible for supervising the student and can be expected to be included as a defendant in lawsuits involving school-related accidents.

2. The rights of the student are that he or she be provided with adequate supervision and instruction during the course of his or her school day.

3. The South Carolina Supreme Court has stated: "Generally, one must be alert for unpredictable acts of children." [Butler v. Temples, 227 S.C. 496, 88 S.E. 2d 586 (1965)]

[3]Hammond v. Scott, 268 S.C. 137, 232 S.E. 2d 336 (1977).

[4]Stuart, Hardwick, Jr., *South Carolina Teachers and the Law* (Danville, Ill.: Interstate Printers and Publishers, Inc.).

4. The South Carolina Supreme Court also rules in the case of Mahaffey v. Ahl, 264 S.C. 241, 214 S.E. 2d 119, 123 (1975) the following:

> Children of tender years and youthful persons generally are entitled to care proportioned to their inability to foresee and avoid the perils they may encounter, as well as to the superior knowledge of persons who come into contact with them. The duty to avoid doing them injury increases with their inability to protect themselves, and with their childish indiscretions, instincts, and impulses. A reasonable man is presumed to know this and to govern his actions accordingly. In all cases, the caution required is according to maturity and capacity of the child – a matter to be determined in each case by the circumstances of that case.

5. In regard to medical attention, teachers have a duty to provide necessary and reasonable safeguards to prevent accidents, injuries, or sickness and to provide prompt treatment for injuries or sicknesses in *cases of emergencies.*

6. A teacher's duty may be to provide special instructions if the materials or activities introduced in the classroom are hazardous or dangerous to the student.

The South Carolina General Assembly passed enabling legislation in 1973 which authorized the school districts to expend public funds for the purpose of acquiring tort liability insurance for their employees. Teachers should inquire if their local districts have procured such insurance. Professional liability insurance is usually offered through the various professional educational associations.

Many school districts require parental permission slips to be signed by parents but this does not provide legal protection from suits since parents cannot waive the personal rights of their minor children.

If a teacher is sued, the teacher should immediately seek legal representation by contacting the Attorney General's Office, the appropriate insurance company, and/or the teacher's personal attorney.

REFERENCES

General Industrial Arts

*Brown; Boyd; Wagner; and Gerrish. *Modern General Shop.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1978.

*Groneman, and Feirer. *General Industrial Education.* Webster Division of McGraw-Hill Book Co., 1979.

*Lindbeck, and Lathrop. *General Industry.* 2d ed. Peoria, Ill.: Charles A. Bennett Co., 1977.

Los Angeles Unified School District. *General Industrial Education.* Encino, Calif.: Glencoe Publishing Co., Inc., 1978.

Miller; Maddox; and Smith. *Exploring Careers in Industry.* Bloomington, Ill.: McKnight Publishing Co., Inc., 1975.

*Olson. *Industrial Arts for the General Shop.* 4th ed. Chamblee, Ga.: Prentice-Hall, Inc., 1973.

Pierson, and Richards. *Industrial Arts Skills-Tools-Careers.* San Diego: Benefer Press, 1979.

Drawing

Bethune. *Essentials of Drafting.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1977.

Brown. *Drafting for Industry.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1978.

Brown. *Blueprint Reading for Construction.* South Holland, Ill.: Goodheart-Willcox Co., Inc.

French; Svenson; Helsel; and Urbanick. *Mechanical Drawing.* Norcross, Ga.: Webster Division of McGraw-Hill Book Co., 1974.

Kicklighter, and Baird. *Architecture, Residential Drawing and Design.* South Holland, Ill.: Goodheart-Willcox Co., 1976.

Walker. *Exploring Drafting - Basic Fundamentals.* South Holland, Ill.: Goodheart-Willcox Co., 1977.

Electronics

Gerrish, and Dugger. *Exploring Electricity and Electronics.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1981.

Gerrish, and Dugger. *Electricity and Electronics.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1980.

Gerrish, and Dugger. *Transistor Electronics.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1979.

Hand, and Williams. *Basic Electronics: Components, Devices and Circuits.* Encino, Calif.: Glencoe Publishing Co., Inc., 1980.

Matt. *Electricity and Electronics.* South Holland, Ill.: Goodheart-Willcox, Co., Inc., 1980.

Mix. *House Wiring Simplified.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1981.

Miller. *Industrial Electricity.* Peoria, Ill.: Charles A. Bennett Co., Inc., 1978.

Rollain; Phillip; and Kraus. *Exploring Electricity/Electronics.* New York: Delmar Publishers, 1971.

Handicrafts

Brennen. *Ceramics.* South-Holland, Ill.: Goodheart-Willcox Co., Inc.

Groneman. *Leathercraft.* Peoria, Ill.: Charles A. Bennett Co., Inc.

*State-adopted textbooks, 1979.

Hess. *Plastics Laboratory Procedures.* Bobbs-Messell Co., Inc., 1980.
Kicklighter, and Baird. *Crafts.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1980.
Lindbeck; Duenk; and Hansen. *Basic Crafts.* Peoria, Ill.: Charles A. Bennett Co., Inc., 1969.
Steele. *Exploring the World of Plastics.* Buford, Ga.: McKnight Publishing Co., 1977.
Smith. *The Fundamentals of Leather Carving.* Houston: Tandy Leather Co.
Zimmerman. *Leathercraft.* South Holland, Ill.: Goodheart-Willcox Co., Inc.
Zimmerman. *Upholstering Methods.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1981.

Graphic Arts

Broekhuizer. *Graphic Communications.* Bloomington, Ill.: McKnight Publishing Co., 1973.
Cogoli. *Photo-Offset Fundamentals.* Bloomington, Ill.: McKnight Publishing Co., 1980.
Dennis. *Lithographic Technology.* Indianapolis: Bobbs-Merrill Educational Publishing, 1980.
Dennis, and Jenkins. *Comprehensive Graphic Arts.* Indianapolis: Howard W. Sams and Co., Inc., 1977.
Kagy. *Graphic Arts.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1978.
Lathrop, and Kunst. *Photo Offset.* Chicago: American Technical Society, 1979.
Miller, and Broekhuizer. *Graphic Arts.* Bloomington, Ill.: McKnight Publishing Co., 1978.
PICA Foundation. *PICA Graphic Communications Curriculum Guide.* Charlotte: PICA Foundation.
Prust. *Photo-Offset Lithography.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1977.
Silver. *Graphic Layout and Design.* Florence, Ky.: Delmar Publishers, 1981.
Walker. *Graphic Arts Fundamentals.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1980.

Home and Building Maintenance

Feirer. *Carpentry and Building Construction.* Peoria, Ill.: Charles A. Bennett, Co., Inc., 1976.
Morton; Guthrie; Inman; and Geuther. *The Home: Its Furnishings and Equipment.* 2d ed. Norcross, Ga.: Webster Division of McGraw-Hill Book Co., 1979.
Weiss. *Home Maintenance.* Peoria, Ill.: Charles A. Bennett, Co., Inc.
Wooden, and Hayes. *Home and Building Maintenance.* Bloomington, Ill.: McKnight Publishing Co., 1969.

Metalwork

Althouse; Turnquist; and Bowditch. *Modern Welding.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1980.
Johnson. *General Industrial Machine Shop.* Peoria, Ill.: Charles A. Bennett, Co., Inc., 1979.
Johnson. *Technical Metals.* Peoria, Ill.: Charles A. Bennett Co., Inc., 1981.
Johnson, and Leibowitz. *Basic Sheet Metal Skills.* Florence, Ky.: Delmar Publishers, 1977.
Johnson, and Leibowitz. *Advanced Sheet Metal Skills.* Florence, Ky.: Delmar Publishers, 1978.
Kennedy. *Welding Technology.* 1st ed. Indianapolis: Bobbs-Merrill Co., Inc., 1980.
Ludwig; McCarthy; and Repp. *Metalwork Technology and Practice.* Bloomington, Ill.: McKnight Publishing Co., 1975.
McCarthy, and Repp. *Machine Tool Technology.* Bloomington, Ill.: McKnight Publishing Co., 1979.
Sacks. *Welding: Principles and Practices.* Peoria, Ill.: Charles A. Bennett, Co., Inc., 1981.
Walker. *Modern Metalworking.* South Holland, Ill.: Goodheart-Willcox Co., Inc., 1976.

Power Mechanics

Engine Service Association. *Air Cooled Engine Mechanics Training Manual.* Milwaukee: Engine Service Assocation.

Gray, and Barrow. *Small Gas Engines.* Chamblee, Ga: Prentice-Hall Inc., 1976.

Stephenson. *Power Technology.* Florence, Ky.: Delmar Publishers.

Turner. *Small Engines.* Vol. I. Athens, Ga.: American Association for Vocational Instructional Materials, 1979.

Turner. *Small Engines.* Vol. II. Athens, Ga.: American Association for Vocational Instructional Materials, 1979.

Vocational Education Media Center. *Small Gasoline Engines, 850-50.* Columbia, S.C.: State Department of Education.

Vocational Education Media Center. *Small Gasoline Engines: Float-Type Carburetor Repair.* Columbia, S.C.: State Department of Education.

Vocational Education Media Center. *Small Gasoline Engines.* Modules 1-9. Columbia, S.C.: State Department of Education.

Walker. *Exploring Power Technology.* South Holland, Ill.: Goodheart-Willcox Co., Inc.

Woodwork

Cunningham, and Holtrop. *Woodshop Tool Maintenance.* Revised. Peoria, Ill.: Charles A. Bennett Co., Inc.

Feirer. *Cabinet Making and Millwork.* Rev. ed. Peoria, Ill.: Charles A. Bennett Co., Inc., 1977.

Feirer, and Hutchings. *Advanced Woodwork and Furniture Making.* Peoria, Ill.: Charles A. Bennett Co., Inc.

Getting the Most Out of Your Lathe. Pittsburg: Rockwell Manufacturing Co., Delta Tool Division.

Joyce. *The Encyclopedia of Furniture Making.* New York: Drake Publishers.

Quimet. *Woodcraft Gift Projects.* Middle Village, N. Y.: Jonathan David Publishers, Inc.

Using Hand Tools, Part 2. Vocational/Industrial Arts Series. St. Louis: Milliken Publishing Co.

Wagner. *Modern Carpentry.* South Holland, Ill.: Goodheart-Willcox Co., Inc.

Zimmerman. *Exploring Woodworking.* South Holland, Ill.: Goodheart-Willcox Co., Inc.

Energy and Environment

Current Energy and Ecology. Highland Park, Ill.: Curriculum Innovations, Inc.

National Science Teachers Association. *Interdisciplinary Student/Teacher Materials in Energy, the Environment, and the Economy.* Oak Ridge, Tenn.: U.S. Department of Education.

Office of General Education. *Environmental Education.* Columbia, S.C.: South Carolina Department of Education.

Office of General Education. *Resources for Environmental Education.* Columbia, S.C.: South Carolina Department of Education.

Schwaller. *Energy Technology: Sources of Power.* Worcester, Maine: Davis Publications.

South Carolina Energy Office. *The Energy Book.* Columbia, S.C.: South Carolina Department of Education.

The Branch. Boulder, Colorado: Project Learning Tree.

Virginia Department of Education. *Technological Resources for Industrial Arts Instruction.* Richmond, Va.: D.A. Education Service.

Safety

Eye Safety Materials for Grades 7-12. National Society to Prevent Blindness, 79 Madison Avenue, New York, N. Y.

National Safety Council. *Safety: Poster Directory No. 254 and General Materials Catalog No. 245.* National Safety Council, 444 North Michigan Avenue, Chicago, Ill.

Shop and Personal Safety TDT21. Transparency Duplicating Book. St. Louis: Millikin Publishing Co.

South Carolina Industrial Arts Safety Guide. Columbia, S.C.: South Carolina Department of Trade and Industrial Education.

Stuart, Hardwicke, Jr. *South Carolina Teachers and the Law.* Danville, Ill.: The Interstate Printers and Publishers, Inc.

Laboratory Facilities

"How to Plan a School Workshop." Rockwell Manufacturing Co., 3550 McCall Place, Atlanta, Ga. 30340.

Praaken, Lawrence W., *et al. Modern School Shop Planning.* Ann Arbor, Michigan: Parker Publications, 1965.

Silvius, and Curry. *Managing Multiple Activities in Industrial Education.* Bloomington, Ill.: McKnight and McKnight Publishing Co., 1972.

Free or Inexpensive Materials

Consumer Information Center, Department C, Pueblo, Colorado (catalogue of infomation on various free and low-cost publications.)

Educational Films Catalog No. 9. South Carolina Department of Education, Audio-Visual Library, Columbia, S.C.

Educators Guide to Free Audio and Video Materials. Educators Progress Service, Inc., Randolph, Wis.

Educators Guide to Free Films. Educators Progress Service, Inc., Randolph, Wis.

Educators Guide to Free Filmstrips. Educators Progress Service, Inc., Randolph, Wis.

Educators Index of Free Materials. Educators Progress Service, Inc., Randolph, Wis.

OCD Publications. Center for Occupational Curriculum and Development, University of Texas at Austin, Austin, Texas.

Teaching Kit. Charles Edison Fund, 101 South Harison St., East Orange, New Jersey, (energy/environment information).

Vertical File Index. (Subject and Title Index to Selected Pamphlet Materials), H. W. Wilson Co., Bronx, New York.

INDUSTRIAL ARTS EQUIPMENT LIST

In establishing a new industrial arts education program, school districts should be cognizant of the equipment and accessories needed to set up a laboratory. The equipment and accessories listed in the following six areas were selected as the basic items needed and should not be construed as the only equipment necessary.

This is not a state-approved list. The committee of instructors who compiled this list is only suggesting adequate equipment and accessories to begin a program in any of the industrial arts areas.

Because of various sources of funding on the local level, the school administration may be able to expand the offerings and add to the list. For more information concerning the prices, equivalent equipment which may be substituted, and State Department funding, contact the Industrial Arts Consultant, Office of Vocational Education, State Department of Education, 1429 Senate Street, Columbia, South Carolina 29201.

Handicrafts

Laboratory Equipment for Ceramics

1 kiln, firing (large, up to 2500°F)	AMACO	HF–105
1 kiln, testing (small)	AMACO	AH–30
1 potter's wheel, electric	AMACO	1
1 potter's wheel, kick wheel	AMACO	15
4 work benches, heavy duty	Brodhead–Garrett	6083G3
1 air compressor	Champion	12C10PC
1 spray booth with gun	AMACO	320930
1 stand for spray booth	AMACO	320940

Laboratory Hand Tools and Accessories for Ceramics

4 modeling tools, assorted	AMACO	700
20 safety goggles	Craftman	9GT1859
4 wedging boards	AMACO	3
6 decorating wheels (8")	AMACO	80

Laboratory Equipment for Leather

2 leather bench units, complete	Brodhead–Garrett	310721

Laboratory Equipment for Plastics

1 plastic starter program	Midwest	76445

Mechanical Drawing and Drafting

Laboratory Equipment

1	drafting desk	Brodhead–Garrett	WD33
1	drafting machine (36" x 37½" x 60")	Brodhead–Garrett	Mark 12-12
20	drafting tables	Brodhead–Garrett	WD60
1	machine, reproduction (dry or moist type)	Brodhead–Garrett	4K48
1	ship curve	Brodhead–Garrett	1020
1	light table (18" x 20")	Brodhead–Garrett	552857
1	chalkboard, drafting machine	Brodhead–Garrett	VEMCO 48" x 10"

Laboratory Hand Tools and Accessories for Mechanical Drawing and Drafting

1	blackboard compass (18")	Utley	64–540
1	blackboard protractor (15½")	Brodhead–Garrett	1794
1	blackboard straightedge (36")	Brodhead–Garrett	1792
1	blackboard, T-square (24")	Brodhead–Garrett	1791
1	blackboard, triangle (24")	Brodhead–Garrett	1793
20	drawing boards (24" x 36")	Paxton–Patterson	38–6710
1	compass, beam	Hearligy & Co.	961–A
20	curves, transparent plastic	Hearligy & Co.	T–92–A
20	drawing instruments	Brodhead–Garrett	780
10	lettering sets	Brodhead–Garrett	AMES No. 176
1	pantograph, drafting	Brodhead–Garrett	1496A
1	parallel ruling straightedge (36")	Brodhead–Garrett	14
20	triangles, 30°–60° (10")	Brodhead–Garrett	630
20	triangles, 45° (8")	Brodhead–Garrett	945
1	UNITEC lettering set	Brodhead–Garrett	42–1012
20	triangle drawing scales	Brodhead–Garrett	31
1	triangle, lettering guide, 45° (5")	Brodhead–Garrett	53
20	T-squares (36")	Brodhead–Garrett	330589

Electricity

Laboratory Equipment for Electricity

1	grinder, pedestal	Baldor	612
1	press, drill, pedestal type (15")	Rockwell	15–339
1	drill, electric (¼")	Rockwell	619
1	drill, hand (¼")	Brodhead–Garrett	03-624
1	drill, twist (number set)	Brodhead–Garrett	DR–12
1	drill, twist (letter set)	Brodhead–Garrett	DR–14
1	drill, twist straight shank (fractional set)	Brodhead–Garrett	18
6	soldering guns, electric (240–325 watts)	Weller	D–550–3
3	keyhole saws (12", 8-point)	Brodhead–Garrett	392633

Laboratory Hand Tools and Accessories for Electricity

2	extension cords, 3–wire, 12–gauge (25')	Brodhead–Garrett	15175
1	gauge, screw pitch	Starrett	40
1	gauge, thickness (Feeler)	Starrett	66
1	drill stand, fractional	Brodhead–Garrett	29
1	gauge, wire and sheet metal (USS)	Starrett	283
1	gauge, wire and sheet metal (American)	Starrett	285
20	goggles, baffled ports	Brodhead–Garrett	127479
4	hammers, ball pein, 12 oz.	Stanley	54–012
4	hammers, claw, 13 oz.	Stanley	52–013
10	crimping tools	Brodhead–Garrett	92609
2	lights, extension (25')	Beldon	15186
1	magnet, bar (2")	Brodhead–Garrett	842
4	oilers, bench, 1/3 pint, 5" spout	Brodhead–Garrett	135C
2	oil stones, combination	Brodhead–Garrett	JB8
6	pliers, combination (6")	Brodhead–Garrett	6"
6	pliers, diagonal cutting (6")	Brodhead–Garrett	6"
6	pliers, duckbill (4")	Brodhead–Garrett	4"
6	pliers, needle nose (6")	Brodhead–Garrett	6"
6	pliers, side cutting (7")	Brodhead–Garrett	7"
1	pliers, vise-grip wrench (10")	Brodhead–Garrett	10R
1	punch, plus chisel, center (set)	Brodhead–Garrett	391
1	punch, chassie, round set (6½"–1 1/8")	Brodhead–Garrett	731
1	punch, chassie, square set (3/4")	Brodhead–Garrett	731
1	reamer, taper	Brodhead–Garrett	12
4	rules, steel (24")	Brodhead–Garrett	62
4	saws, coping	Brodhead–Garrett	15–106
4	saws, hack, hand	Brodhead–Garrett	348
4	saws, hand, crosscut, 12-point	Brodhead–Garrett	26"
1	scissors	Brodhead–Garrett	925
4	screwdrivers, assortment	Brodhead–Garrett	430
1	screwdriver set, Phillips	Brodhead–Garrett	4004
2	screwdrivers, retainers	Brodhead–Garrett	295984
2	snips, aviation, left	Brodhead–Garrett	200296
2	snips, aviation, right	Brodhead–Garrett	200303
2	snips, tinners, straight (12")	Brodhead–Garrett	200113
6	soldering copper, electric pencil	Weller	WP40
4	squares, combination (12")	Stanley	122
4	squares, steel framing (16" x 24")	Stanley	100

Power Mechanics Through the Small Gasoline Engine

Laboratory Equipment for Power Mechanics Through the Small Gasoline Engine

4	benches, work (5' x 30")	Brodhead–Garrett	6123T
1	tester, magneto	Brodhead–Garrett	24–603
4	vises (4")	Wilton	644
1	micrometer set, outside (1"–3")	Starrett	171346
1	dial calipers	Midwest	47863
1	drill, electric, 1/3 HP or larger with 1/3" chuck cap	Rockwell	7511
1	micrometer set, inside (2"–8")	Starrett	124AZ

Laboratory Hand Tools and Accessories for Power Mechanics Through the Small Gasoline Engine

2 plunger bushing counter bore reamer and driver	Briggs & Stratton	19056 & 19057
2 hones, finishing	Brodhead–Garrett	855
2 pullers, flywheel	Briggs & Stratton	SE10
2 seaters, valve	Briggs & Stratton	301S
1 telescoping gauge	Starrett	229A,B,C
6 thickness gauges	Starrett	66
6 master feeler gauges	Miller–Falls	9–03
2 cleaners, ring groove	Brodhead–Garrett	221
2 compressors, piston ring	Brodhead–Garrett	217
2 compressors, valve spring	Brodhead–Garrett	131
4 hammers, ball pein (16 oz.)	Stanley	016
4 hammers, lead (20 oz.)	Stanley	107008
6 pliers, combination	Brodhead–Garrett	6"
6 pliers, needle nose (6")	Brodhead–Garrett	6"
6 pliers, side cutting (7")	Brodhead–Garrett	7"
6 pliers, snap ring	Brodhead–Garrett	4440R
6 screwdriver sets, assorted	Brodhead–Garrett	SH72
4 screwdrivers, Phillips	Brodhead–Garrett	4004
2 wrenches, torque	Brodhead–Garrett	74010
2 wrenches, Allen, 9-key set	General	894
4 wrenches, 7-piece set	Brodhead–Garrett	1707
5 wrenches, complete set of 1/4", 3/8", 1/2" drive, socket set	Brodhead–Garrett	4250
1 wrench, vise grip (7")	Vise Grip	7R

Woodworking

Laboratory Power Equipment for Woodworking

1 grinder, two-end, with mfg. stand (7")	Baldor	SP7P1MD
1 planer (13" x 6")	Rockwell	22436
1 press, drill, floor model, utility, 115 volts (15")	Rockwell	15–091
1 sander, delta belt and disc	Rockwell	31–730 & 52–612
1 sander, orbital, finishing	Rockwell	505
1 sander, spindle	Boyce–Crane	2025
1 saw, band (14")	Brodhead–Garrett	28–300
1 saw, circular, tilting arbor, UNISAW (10")	Brodhead–Garrett	34–744
1 saw, scroll or jig (24")	Brodhead–Garrett	013707
4 lathes (12")	Brodhead–Garrett	587320
1 radial saw with stand (10")	DeWalt	7770
1 jointer (6")	Rockwell	37–220
1 belt sander, portable (4" x 24")	Stanley	90–497
1 air compressor, portable	Champion	12C10PC
5 benches, 4-station work with quick acting vises	Brodhead–Garrett	SB7
1 saw, sabre	Brodhead–Garrett	648
1 vise, machinist (4")	Columbian	D44
1 drill, electric, heavy duty (1/4")	Rockwell	619
1 drill, hand	Brodhead–Garrett	03624
1 electric drill, portable (3/8")	Rockwell	7511

Laboratory Hand Tools and Accessories for Woodworking

1	bob, plumb (8 oz.)	Brodhead–Garrett	171
6	surform sets, file type	Stanley	21–295
4	tapes, rule (12' x 3/4")	Stanley	33–312
4	awls, scratch (6")	Brodhead–Garrett	61–007
1	bar, ripping (3/4" x 24")	Brodhead–Garrett	55–124
2	bit sets, auger (1/4"–1" by 16th)	Irvin	D–13
2	bit sets, drill, high speed	Brodhead–Garrett	18
1	bit, expansion (7/8" to 3")	Stanley	10
1	bit set, screwdrivers for brace	Stanley	81991
4	braces, ratchet, 10" swing	Stanley	02–945
4	calipers, inside (8")	Starrett	73–8
4	calipers, outside (8")	Starrett	79–A–8
1	chalk line reel (100')	Brodhead–Garrett	47–100
1	chisel set, cold (1/4",3/8",1/2",5/8")	Brodhead–Garrett	H–150
4	chisel sets, wood (1/4" to 1 1/2" x 1/4")	Stanley	16–400
4	clamps, bar (4')	Brodhead–Garrett	224797
4	clamps, C (6")	Brodhead–Garrett	185376
4	file cards	Brodhead–Garrett	240901
1	cord, extension with guard (25')	Brodhead–Garrett	15–175
2	countersink, 4-bit sets	Brodhead–Garrett	5–10
2	cutters, glass, ball end	Brodhead–Garrett	No. 02
4	dividers, 8" legs	Brodhead–Garrett	No. 838"
1	dresser wheel	Brodhead–Garrett	243278
1	kit, first aid	Johnson & Johnson	8116
1	points, trammel	Brodhead–Garrett	523
2	routers	Rockwell	4672
3	rules, folding fiberglass with extension (6')	Brodhead–Garrett	162061
3	saws, back (14", 13-point)	Brodhead–Garrett	235975
1	saw, compass, key holes (14", 8-point)	Brodhead–Garrett	392644
2	saws, coping, 3 blades	Brodhead–Garrett	75
3	saws, hand, cross cut	Brodhead–Garrett	26"
1	miter box (10")	Brodhead–Garrett	85–306
3	saws, hand, rip (26")	Brodhead–Garrett	26" 5½ pt.
4	screwdriver sets, assorted	Brodhead–Garrett	430
4	screwdriver sets, Phillips	Brodhead–Garrett	4004
2	snips, aviation (10")	Brodhead–Garrett	200314
2	snips, tin, combination	Brodhead–Garrett	200180
2	snips, tin, duckbill (10")	Brodhead–Garrett	200220
2	snips, tin, straight (12")	Brodhead–Garrett	200113
4	squares, bevel, adjustable	Brodhead–Garrett	46–8128"
4	squares, combination with level	Brodhead–Garrett	46–122
4	squares, framing (16"x24" SF)	Brodhead–Garrett	45–100
2	stones, oil (8")	Brodhead–Garrett	FJB8
1	tool carving set	Brodhead–Garrett	No. 8
1	wrench set, adjustable (8")	Brodhead–Garrett	194760
1	wrench set, Allen	Craftman	360
1	wrench set, combination, 14 to set	Brodhead–Garrett	1714
1	vise, grip wrench (10")	Brodhead–Garrett	10R
1	safety can, 5 gal.	Midwest	U1–50S
1	waste can, 6 gal.	Midwest	906–FL
4	lathe turning tool sets	Rockwell	46–130

Laboratory Hand Tools and Accessories for Woodworking (cont.)

2	frames, hack saw (10–12")	Brodhead–Garrett	368
2	gauges, marking (6")	Brodhead–Garrett	47–061
20	goggles, safety	Brodhead–Garrett	127479
1	gouge, India slip stone	Brodhead–Garrett	FS76
1	gun, stapling	Swingline	101
2	hammers, ball pein (12 oz.)	Brodhead–Garrett	54–012
4	hammers, claw (13 oz.)	Brodhead–Garrett	52–013
1	hammer, tack, upholsterer's (5 oz.)	Stanley	53–304
2	knives, putty	Stanley	2S
1	level, aluminum spirit (24")	Goldblatt	42–42424"
4	mallets, wooden, tinners (2 1/2" x 5 1/2")	Brodhead–Garrett	228130
2	nails, set packs (1/32", 2/32", 3/32")	Brodhead–Garrett	58–230
1	nippers, end cutting (10")	Brodhead–Garrett	186–832
2	oilers, bench, 1/3 pint, 5" spout	Brodhead–Garrett	6"
1	oiler, trigger pressure, flexible spout	Brodhead–Garrett	595990
3	planes, block	Brodhead–Garrett	13–019
2	hammers, claw (16 oz.)	Brodhead–Garrett	51–616
2	hammers, soft-face	Brodhead–Garrett	57–594
12	handscrews, adjustable (6")	Brodhead–Garrett	224954
12	handscrews, adjustable (12")	Brodhead–Garrett	224998
3	planes, Jack (9')	Brodhead–Garrett	12–005
1	punch, set	Brodhead–Garrett	391
2	pliers, needle nose (6")	Brodhead–Garrett	6"
2	pliers, side cutting (7")	Brodhead–Garrett	7"
2	pliers, slip joint combination (6")	Brodhead–Garrett	6"

Metalworking

Laboratory Equipment for Metalworking

1	metal turning lathe (10")	Brodhead–Garrett	272687
1	lathe, accessory package	Brodhead–Garrett	BG500
1	shears, squaring	Pexto	152
1	box and pan brake	Pexto	PX–36
1	grinder, two end with mfg. stand (7")	Baldor	SP7P1MD
1	press, drill, floor model, utility, 115 volts (15")	Rockwell	15–091
1	bar folder	Pexto	155
1	bench, sheetmetal, with two stake plates (60" x 40" x 33 1/4")	Brodhead–Garrett	SM60–S
4	workbenches, open (6' x 34")	Midwest	11718
1	welder, oxyacetylene	Marquette	20–023
1	truck, gas cylinder	Marquette	26–375
1	tool set, metal working	Brodhead–Garrett	TS11–T
1	Foundry Programmed Package, unit	Brodhead–Garrett	AL–7A
1	welder, arc	Lincoln	AC–225S
1	anvil	Brodhead–Garrett	206818
1	anvil stand	Brodhead–Garrett	No. 10
8	vises, bench	Wilton	645

4	goggles, welding	Marquette	51–101
8	gloves, welding	Marquette	25GH
8	aprons, leather, bib-type	Marquette	400
1	lighter, flint	Marquette	26311
2	chipping hammers/brushes	Marquette	15916
1	cleaner, tip	Whipo	203016
4	helmets, lift-front	Brodhead–Garrett	262055
4	cape sleeves, leather	Brodhead–Garrett	493265
1	dresser wheel	Brodhead–Garrett	243278